



Abstract 3D printed sensors based on modified-polylactic acid for

electrochemical sensing *

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Abstract: A wide variety of materials have historically been considered when developing electro-11 chemical sensors. Initial studies relied on mercury electrodes, which were soon replaced by different 12 inert metals (mainly Au and Pt) and carbon-based materials (e.g., glassy carbon electrodes). How-13 ever, the performance of such bare electrodes is usually limited, lacking the sensitivity and/or selec-14tivity required for the analysis of complex real samples. In this direction, modification of electrode 15 surfaces with different electrocatalysts was explored as a solution given their more efficient electron 16 exchange and/or faster reaction rate. This lead to the popularization of chemically modified elec-17 trodes (CMEs), with carbon paste electrodes first, and screen printed electrodes later, as the most 18 common choices. 19

Nowadays, 3D-printing is emerging as an alternative approach for the fabrication of customized 20 electrochemical sensors, owing to their many unique advantages such as its low-cost (both of the 21 material and equipment), tunability and easy prototyping. Concretely, electrodes are fabricated by 22 fused deposition modelling from thermoplastics such as polylactic acid (PLA) or acrylonitrile-buta-23 diene-styrene (ABS), commonly doped with different carbon-based materials to overcome the insu-24 lating nature of PLA and ABS. In this regard, herein we explore the preparation of bulk-modified 25 26 conductive filaments through the incorporation of redox mediators/electrocatalysts for the manufacturing of 3D-printed voltammetric sensors. Developed electrodes were characterized electro-27 chemically by cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS), and 28 morphologically by scanning electron microscopy-energy dispersive X-ray spectroscopy (SEM-29 EDX). Finally, their performance was benchmarked against commercial electrodes and applied for 30 the voltammetric detection of drugs. 31

Keywords: 3D printing; additive manufacturing; modified electrode; voltammetric sensors; con-32ductive filaments; melatonin; hydrogen peroxide; Prussian blue33

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